of saturation have been obtained by Samuel Fortier (see Engineering Record of April 15, 1905, p. 430).

Additional experimental data along this line would be of the utmost practical and economic value, not only in relation to the ordinary problems of hydrology in estimating stream flow, but also in relation to irrigation, land drainage, and agricultural engineering in general. The writer has designated the ratio of the actual evaporation rate from a soil surface at any given time and with any degree of saturation to the evaporation rate from water or a saturated soil surface as the "evaporation opportunity."[1]

It so happens that in long periods of drought, when the evaporation rate from a saturated surface is highest, the evaporation opportunity from the soil surface decreases. It is a natural result of these opposing influences that there is some particular amount and distribution of rainfall in any locality for which the total evaporation loss from the soil is a maximum.

[1] "Relative evaporation" or "Evaporativity" might be a more suggestive designation. See MONTHLY WEATHER REVIEW, Jan. 1919, 47:30.—EDIT.

Although this is important, the writer does not think that it has ever hitherto been pointed out. Strangely enough, it follows as a simple mathematical deduction from a number of existing formulas for calculating run-off and, furthermore, it is abundantly confirmed by experience, inasmuch as it will be found that if almost any long-term record of rainfall and stream flow is analyzed, and the results are plotted in terms of water losses against precipitation, the resulting water losses will have a maximum for an annual rainfall which generally lies between 45 and 75 inches in England and the eastern United States.

This calls attention to the fact that the older ideas and methods of expressing run-off as a percentage of rainfall are essentially fallacious, and if engineers are to justify public confidence with regard to their ability to predict safely the available yield of water-supplies, their work must, in the future, be founded upon the use of meterologic data now often ignored and upon more rational and detailed methods of analyzing and utilizing such data.

ELEMENTS OF HYDROLOGY.

By ADOLPH F. MEYER, C. E., Associate Professor of Hydraulic Engineering, University of Minnesota.

[John Wiley & Sons (Inc.), New York, 1917, pp. 487, 287 figs.]

This volume is a welcome addition to our knowledge of hydrology and its practical application. It was prepared for the use of professional men, teachers and students of engineering, and aims to set forth the fundamental data and considerations rather than to provide a text book.

After defining hydrology and its applications the author presents in Chapter II a résumé of the physical properties of the atmosphere with a more or less condensed account of the variations of the several meteorological elements, closing with a brief reference to the general circulation of the atmosphere as manifested in the winds. Chapter III is devoted to a consideration of water, its various states and properties. Chapter IV on precipitation is a very complete résumé of the essential facts concerning the occurrence of precipitation and its geographic distribution. The remaining chapters deal with evaporation, from land and water surfaces transpiration, deep seepage, run-off, stream-flow data, supplementary stream-flow data, and modification of stream flow by storage.

The book is unusually rich in illustrative material, drawn largely from Federal and State reports, from private sources, as well as from the author's original investigations.—*A. J. H.*

THE WEATHER AND DAILY STREAM FLOW FOR HYDRO-ELECTRIC PLANTS.

By J. CECIL ALTER, Meteorologist.

[Dated: Weather Bureau, Salt Lake City, Utah, Apr. 11, 1919.]

SYNOPSIS.—The important part played by daily weather forecasts in the problem of water regulation for hydroelectric plants in Utah is brought out in this paper. The writer compares this work with the daily prediction of water stages on eastern rivers. As many of the hydro-electric plant reservoirs are located at least 36 hours' travel (measured by stream flow) from the plants themselves, it is of great importance that weather conditions, particularly as regards precipitation, be accurately known 36 hours in advance. If, for example, rain is expected at the end of any given period of 36 hours the reservoir outlet can be closed and the precious water saved until needed. On the other hand, if a period of dry weather is expected to set in at the end of 36 hours, the outlet at the reservoir must be opened so that the plant will have an abundance of water. These conditions apply equally well to irrigation control.—H. L.

Daily weather forecasts and general meteorological data have for some time entered rather largely into the problem of water regulation for the 27 hydro-electric plants of the Utah Power & Light Co., in northern Utah, and southeastern Idaho, as managed by Maj. Cooper Anderson, superintendent of the power department. The general problem bears some analogy to the daily prediction of water stages on eastern rivers, but many additional factors require serious consideration.

All but four of the plants mentioned are located on the smaller streams coming out of the Wasatch Mountains, the flow of which can be relied upon for running the plants to machine capacity only in the flood time; this is from about March to early June, inclusive, when mountain snow is melting most rapidly, and when precipitation is normally heaviest. During the remainder of the year many of these plants are subject to greatly decreased output for want of water.

In summer and autumn the water supply from snow stores in the mountains reaches a minimum, and this is normally the period of lightest precipitation in this region. A sustained stream flow, ample for power production purposes, occurs in these months only when previous snowfall and current precipitation are abnormally heavy. In winter the tributaries are closed by ice with the first hard freeze, the frost gradually sealing the larger feeders, and finally the trunk stream if the weather be very severe.

It is essential that these scattering plants be operated as fully as possible, because of their nearness and convenience to purchasers of the power produced; and inasmuch as the company provides by far the greater percentage of all electricity used by the mining, smelting, interurban and street railway, sugar refining, city lighting, and other companies in this district, which includes Salt Lake City, Ogden, and probably a score of smaller towns, the demands for current are very exacting.